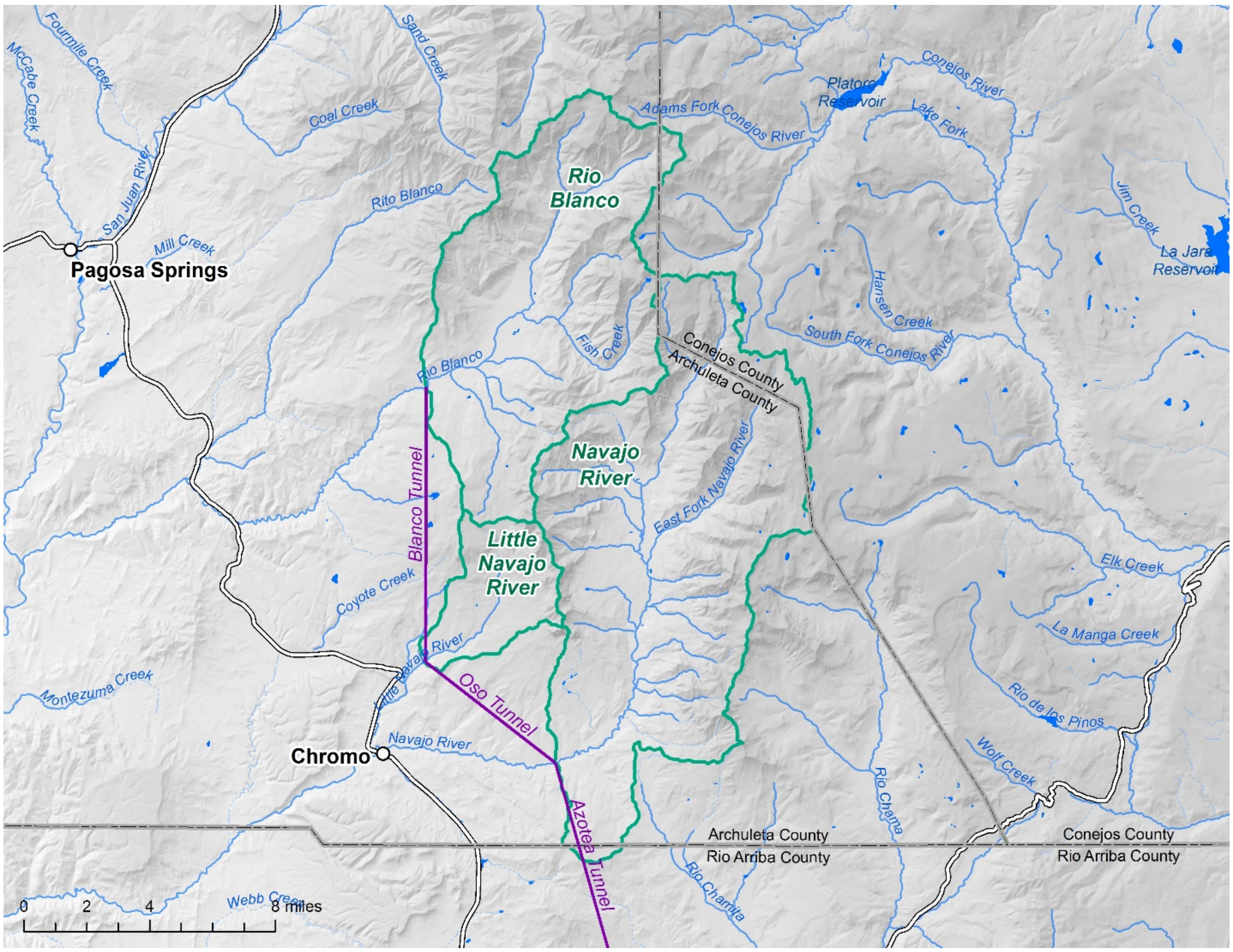
Navajo-Blanco Watersheds Resilience Strategy for the San Juan Chama Project Source Watersheds



Navajo-Blanco Working Group

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Contents

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The following individuals and organizations have participated in the development of the *Navajo – Blanco Watersheds Resilience Strategy* and/or agree with and will assist in implementing this *Navajo – Blanco Watersheds Resilience Strategy* for the benefit of our local community and its surrounding watershed. As such, they are the de facto participants of the "Navajo-Blanco Working Group" as detailed in the strategy narrative.

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Introduction

The watersheds of the upper San Juan River in the San Juan Mountains provide numerous local and regional benefits. Of particular importance are the watersheds of the Blanco and Navajo Rivers. They support fish and wildlife habitat, outdoor recreation, farmland and homes for the local communities. Downstream users rely on the waters provided by the Blanco and Navajo Rivers through the Bureau of Reclamation’s San Juan-Chama Project (SJCP).

Wildfire threatens these watersheds and the natural and social systems that rely on them. Climate change is expected to increase the incidence of fire throughout the Western US and particularly in the wetter forest types such as those found these watersheds (Westerling et al. 2014). Even under current climatic conditions, large wildfire have occurred in similar watersheds within in the San Juan Mountains including the 73,000-acre Missionary Ridge Fire of 2002 and the West Fork Complex of fires that burned 109,615 acres in 2013. It isn’t a question of if the Navajo and Blanco watersheds burn, it’s a matter of when, and under what conditions.

Most wildfires are small and burn at relatively low intensities. These fires burn under relatively mild conditions and can be controlled or suppressed without tremendous expenditures of resources. Extreme weather conditions occur relatively infrequently, but when fires start during these conditions, they are difficult to suppress and burn large areas at high intensities (Finney 2005). Recent research (Westerling et al. 2016) found that frequency and size of large fires in the US have increased each decade since the 1970s. The current worst case scenario may become more common in the future as the climate of the Southwest warms and droughts severity increases (Garfin et al. 2013). The large fire scenario is the most likely to significantly impact the Blanco and Navajo watersheds, and this Resilience Strategy is proposed to reduce the chances of damaging large fires.

The Source Watersheds

The Navajo and Blanco and Little Navajo watersheds are the source watersheds for the SJCP, a trans-basin diversion used to supply drinking water to cities including Albuquerque and Santa Fe, and irrigation water to the Middle Rio Grande Conservancy District. Completed by the U.S. Bureau of Reclamation (USBR) in 1976, the San Juan-Chama Project is a series of dams, tunnels, and reservoirs that divert, store, and release water for the benefit of New Mexico’s allocation under the Colorado River Compact. Check dams, located at the base of the three watersheds divert water through tunnels, which carry runoff 26 miles across the Continental Divide from the Colorado River watershed to the Rio Chama in the Rio Grande watershed.

The total allocation of the San Juan-Chama Diversion Project is divided between 9 municipalities, 6 pueblos, and 2 counties with the City of Albuquerque being by far the largest recipient, receiving over 50% of the project’s water. Within Bernalillo County alone, the Project provides over 50% of the drinking water for a population of over 600,000 residents (ABCWUA 2017). The Project also provides water for industrial uses, irrigation, and fish and wildlife, such as threatened and endangered species like the silvery minnow. An additional benefit of San Juan-Chama Project water is that it is not subject to the terms of the Rio Grande Compact, and must be consumed upstream of Elephant Butte Dam.

Building Resilience through Collaboration

The complex mosaic of land owners in the SJCP landscape requires a collaborative strategy to reduce wildfire risk. Given the importance of these watersheds, The Nature Conservancy, on behalf of the Rio

Grande Water Fund, reached out to existing collaborators in the area. Local private land owners, local, state, federal agencies and other stakeholders formed the Navajo-Blanco Working Group (Working Group) in 2015. The Working Group incorporated partners already engaged to address fire risk and improve forest health by the Chama Peak Land Alliance and the San Juan Headwaters Forest Health Partnership. To help the collaborators adequately identify and address the risks to water delivery, the USBR also became a member of the Working Group.

To develop a comprehensive and implementable strategy, collaborators worked together to develop a common sense of purpose and an agreed upon approach to conducting the needed fire risk reduction actions over the next decade. (See Appendix A for more on the collaborating organizations and Collaborative Statements). The science-based assessment described below provides cross-jurisdictional analyses so that Working Group members can contribute to the success of the strategy by coordinating their existing organizational and agency plans and funding opportunities.

Members agreed that attempting to restore all forest lands to their pre-European settlement condition is impractical. Given the likely drying and warming expected to occur under climate change, current human use and the lack of budgets to address poor forest conditions on every acre, the goal of this strategy is to build forest resilience to severe fires, drought, and insects with strategically placed forest treatments to provide a better chance for forests to “bounce back” after disturbance, and retain key forest ecological processes, critical watershed function and provide the best protection for water infrastructure and local communities.

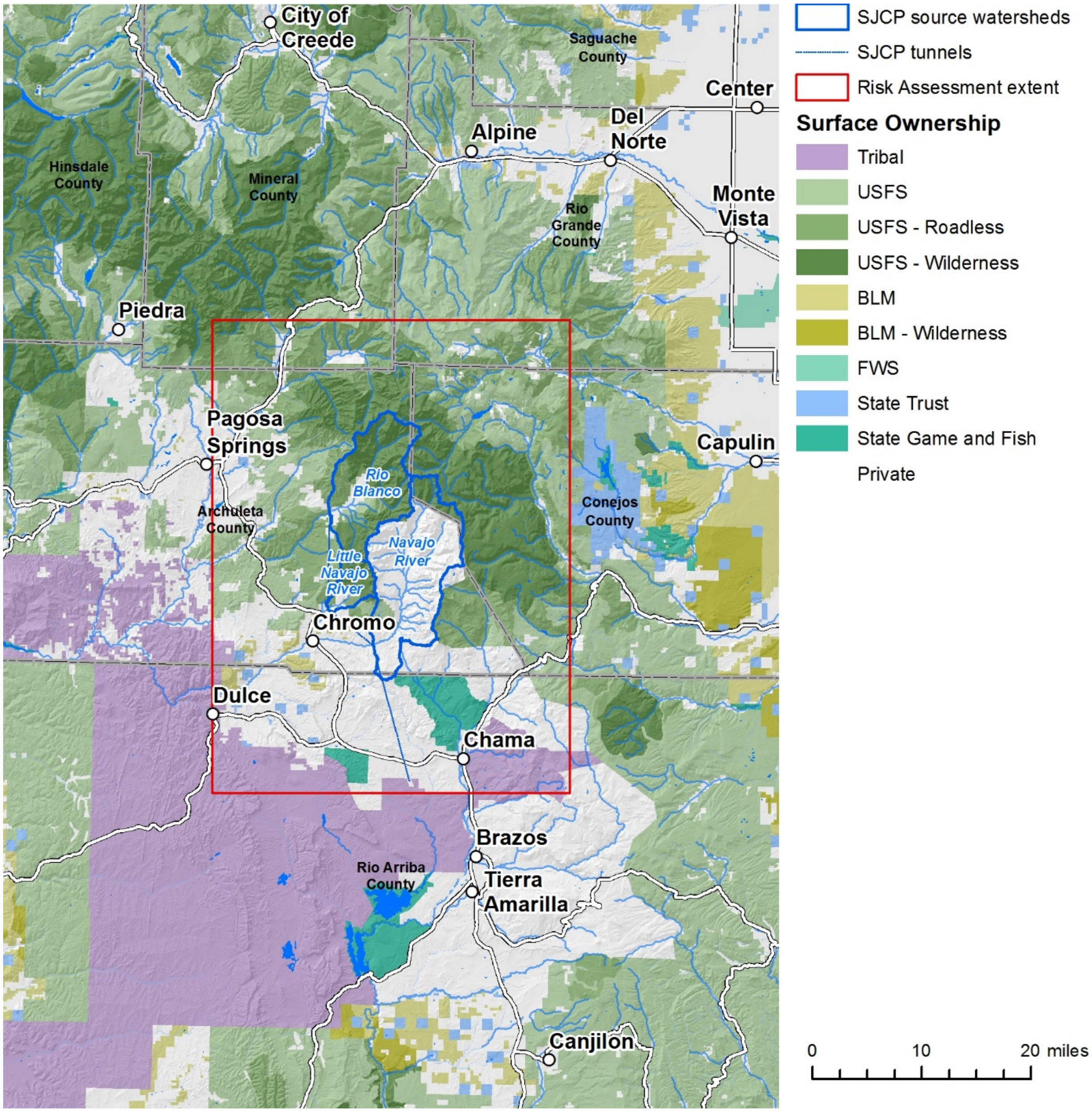

Figure 1. Map of study area showing the San Juan Chama Project (SJCP) source watersheds and the risk assessment boundary.

Strategy Development

The SJCP source watershed area is the core of this Strategy (Figure 1), though because wildfire can spread over large areas, to appropriately capture fire risk, areas outside of the SJCP source watersheds are included in this strategy. This conceptual area between values and the farthest point from which fire starts can spread to reach values has been called a "fireshed" (Bahro et al. 2007). This Strategy includes analysis and evaluation of a fireshed that extends 10 miles beyond the San Juan-Chama Project source watersheds. The analysis area includes large ranches and smaller properties with approximately three hundred homes, as well as lands managed by the San Juan and Rio Grande National Forests.

On behalf of the collaborators, The Nature Conservancy gathered and analyzed information about the three watersheds and surrounding fireshed. To develop a strong foundation for the strategy, information was gathered on values and threats to those values, as well as ecological and social systems within the study area. Collaborators agreed that the goal of the strategy would be to reduce fire risk over the next decade, so a fire risk assessment was used as the foundation of the strategy. Working Group members decided to use a published Wildfire Risk Assessment Framework developed by the USFS to characterize fire risk (Scott et al. 2013). In addition to evaluating fire risk, forest and watershed resilience, and opportunity to mitigate threats were evaluated. Within the strategy, priority is given to projects where risk is high and where ecological resilience will benefit from intervention by managers. Initially areas with high opportunity to treat will be prioritized but investments will also be made in ameliorating the constraints on treatment. Expected return on investment from forest treatment was also evaluated during strategy development to test the theory that treatments make financial sense.

Wildfire Risk Assessment

The Wildfire Risk Assessment Framework (Framework) used during strategy development evaluates fire threats to landscape values and assets (Scott et al. 2013). Members of the Working Group, who are the local subject matter experts, characterized the values and assets within the study area. These values are called Highly Valued Resources and Assets (HVRAs) throughout the analysis. In addition to the evaluating the direct threat from fire to HVRAs, the threat of post-fire hazards like increased sediment and debris flow were also evaluated. The Framework provides a transparent, science-based process to guide the Working Group during the project planning phase of the Strategy.

The Framework is being used in many locations in the Western U.S. to improve the effectiveness of fire hazard reduction treatments. Risk assessments have been completed at the Forest Service Region level, and the San Juan National Forest is applying the Framework forest-wide at a resolution between the regional analyses and this SJCP assessment. The risk assessment completed during development of this strategy is intended to contribute to and be consistent with the regional strategy to reduce fire risk in southwestern Colorado.

The risk assessment supports cohesive Strategy development at several scales with an emphasis on the source watersheds of the San Juan-Chama Project. It is intended to be used to identify areas where wildfire poses the greatest risk and should be mitigated. Following sections document the modeling and analysis used to assess fire risk to values. The accompanying maps and datasets are the primary output of the risk assessment. When the risk metrics from this assessment are combined with data about desired conditions and opportunity for treatment, a treatment strategy can be developed. Appendix B provides a description of the risk assessment process.

The Framework allowed the Working Group to answer a number of questions:

- What size and intensity of fire would occur in the landscape under expected conditions?
- What are the values collaborators are concerned about?
- What values have the greatest exposure to the wildfire hazard?
- How do different intensities of fire affect values?
- Which areas benefit from wildfire?
- How is wildfire risk distributed across the landscape? and,
- Which areas in the landscape are most likely to experience loss, how much loss, and to what set of values?

Defining Fire Risk

Fire risk is a combination of three components: likelihood of fire occurrence, the intensity of fire, and the susceptibility of important values to the effects of fire. These can be visualized as a triangle (

Figure 2).

Figure 2. Risk is the combination of likelihood (the probability that a fire will occur), intensity (how intense a will fire be), and susceptibility (how much damage the fire will cause). Risk is high when likelihood, intensity, and susceptibility are high, and decrease when any factor decreases. The assessment framework used in this assessment assumes the factors used to describe risk are spatially explicit so risk can be described for specific points on the ground. The factors associated with risk can be visualized as a triangle similar to the "fire triangle" used to describe the relationship between the "ingredients" for fire (Scott et al. 2013).

Fire intensity is the term used to describe the heat released from burning fuels at the front of a fire. A manifestation of the amount of heat being released is flamelength. Typically, less intense fires have lower frontal flamelengths than more intense fires. Flamelength is practical and observable measure used to estimate how controllable a fire is and the kinds of effects fires may have on values of interest. To simplify the process of modeling how values react to different intensities of fire, fire intensity classes were created that assumed equal response of fire within class. Classes were delineated in two foot increments (e.g. 0–2', 2–4') up to 12 feet. All flame lengths over 12 feet are in one bin. Fire likelihood was modeled using multiple simulations of fire across the landscape. Thousands of fires were simulated under varying conditions and areas where fires simulated fires burned repeatedly have a higher burn probability. The process used to characterize the susceptibility of important values to damage or loss from varying intensities of fire is described below.

Identifying Values at Risk

The Working Group identified a set of social and ecological values that may be susceptible to fire in the landscape and settled on four major categories to include in the analysis:

1. Watershed Function
2. Private Investment
3. Infrastructure
4. Forest Resilience

Within the Framework, these types are values are described as Highly Valued Resources and Assets, or HVRAs. Each HVRA can include sub-values or sub-HVRAs. For example, the Watershed Function HVRA category includes four HVRAs: snowpack retention, debris flow hazard mitigation, erosion hazard mitigation, and water provisioning. Debris flow hazard has sub-HVRAs identifying different levels of debris flow hazard.

Developing Response Functions for HVRAs

The response of each HVRA and sub-HVRA to different flamelength categories was estimated by experts within the Working Group. The response function was described in terms of either positive or negative net change. While fires of any flamelength may be detrimental to values like homes or other structures which are part of the Private Investment HVRA, the occurrence of fires of lower intensity resulted in positive responses for Forest Resilience. The full list of HVRAs and their response functions can be found in Appendix B.

Results of the Assessment

Conditional net value change was summarized by HVRA category to identify priority areas (Figure 3). These unweighted overlays of value change assume each pixel will burn at equal frequencies. When combined with the probability of a pixel burning under 97th percentile conditions, a true risk metric is created (Figure 4).

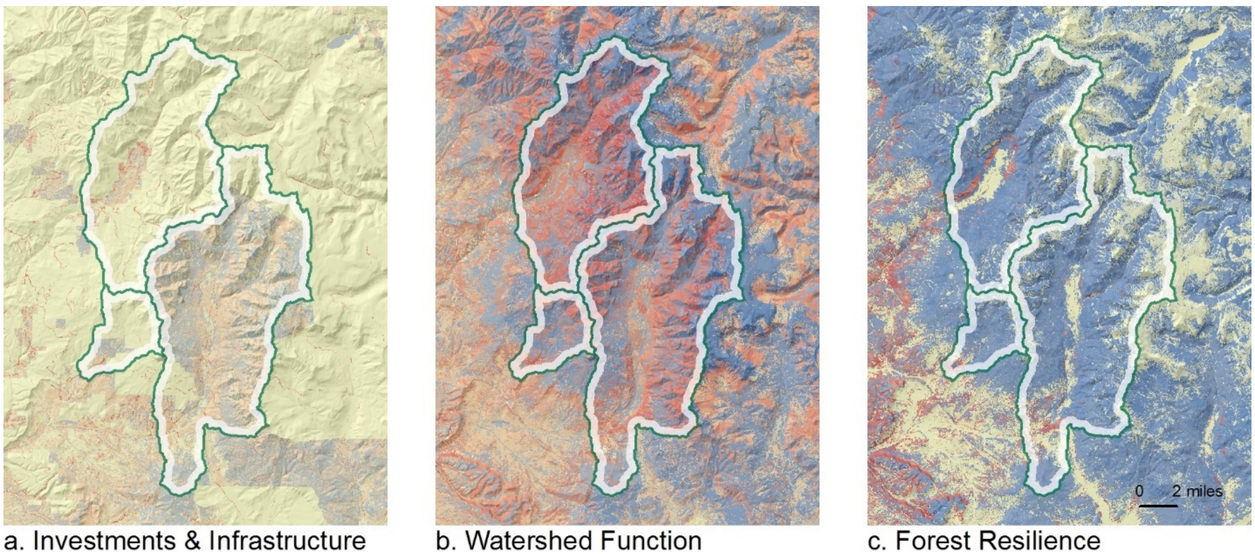

Figure 3. Conditional susceptibility for each HVRA category re-scaled so each category has the same range of susceptibility. These maps show change in value assuming every pixel burns under expected conditions. Blue values are areas where fire has a positive benefit and red areas show negative changes in value. Watershed Function (b) and Private Investments (included in (a)) have been re-scaled using a linear function so their susceptibility values are comparable.

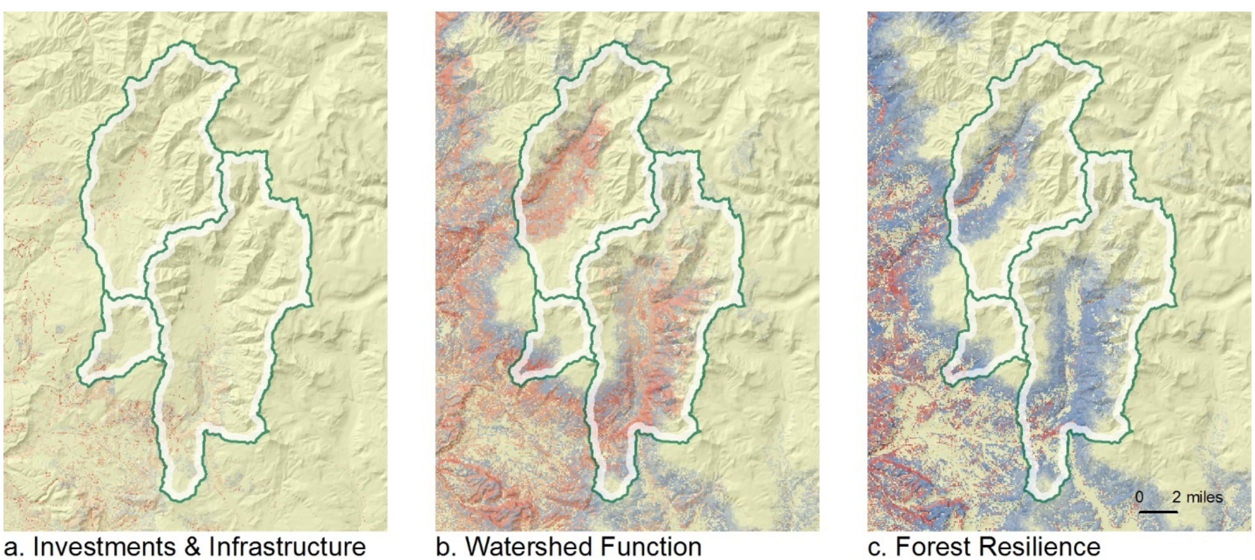

Figure 4. Fire risk for each HVRA category re-scaled so each category has the same range of risk. Blue areas have a positive risk value and will benefit from wildfire while red areas will not benefit from wildfire under current fuel conditions. Yellow-beige areas will have little change in value following fires. These maps show relative fire risk using the modeled burn probability data to account for expected frequency of fire.

Once susceptibility and risk are computed for each HVRA category, they can be combined into a total expected net value change for the landscape. The formal Framework outlined in GTR-315 suggests the relative value of each HVRA be determined, thereby producing one map that represents the true risk to values. In a landscape as complex as the SJCP source watersheds, conducting the due diligence necessary to accurately weight each HVRA would be untenable. Therefore, several weighting schemes are used to allow a range of valuations to be created. None of the weighting schemes are perfect, though from the range of analyzed weighting scenarios, it's easy to see how changing the relative weightings will impact relative risk. The domain of true risk falls somewhere between 100 percent weighting for a single HVRA, to equal weighting of all HVRAs. A slightly elevated weighting for watershed function has been suggested by several working group members (Figure 5), though other weightings can just as easily be used to accommodate differing evaluations of relative importance.

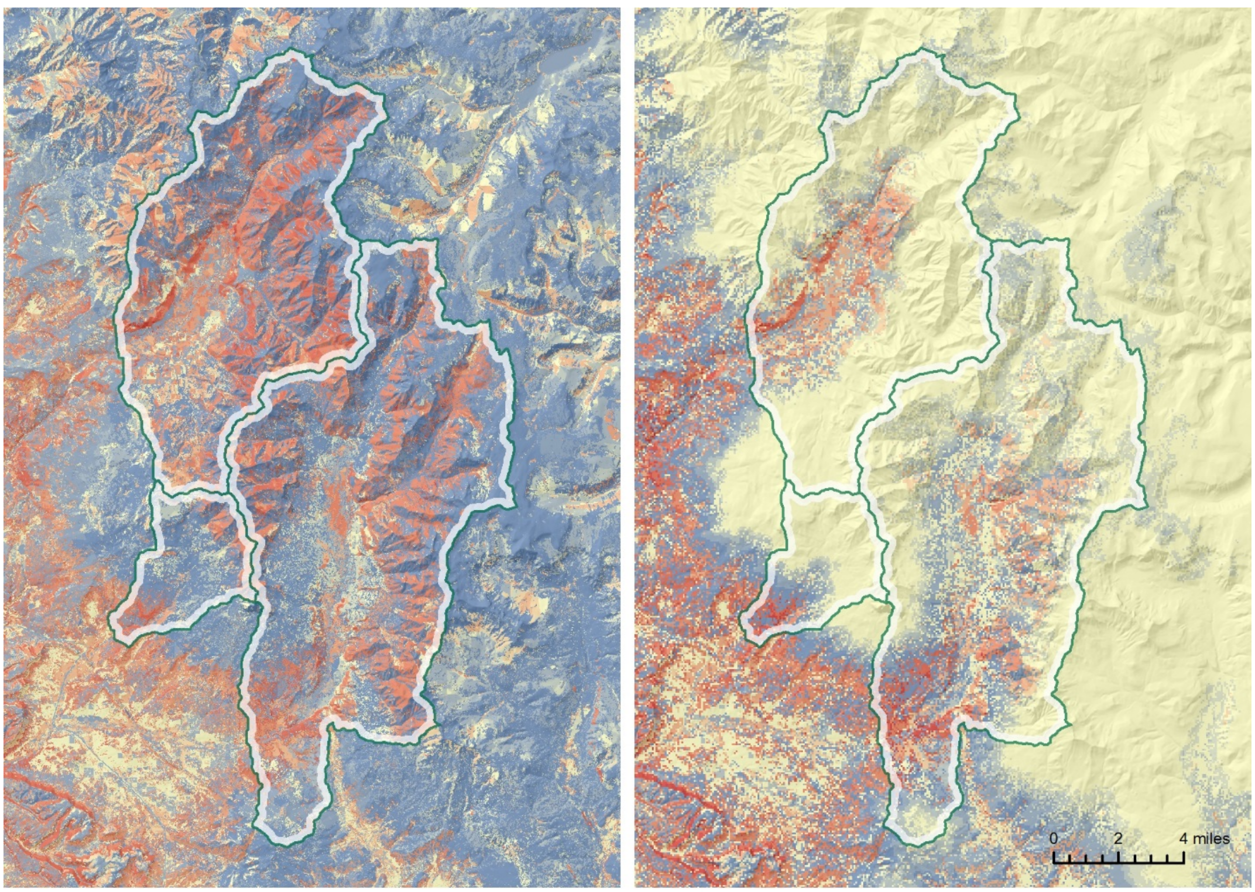

Figure 5. Maps showing relative susceptibility to fire assuming all areas are equally likely to burn (left), and relative fire risk scaled by burn probability (right). Red areas are expected to experience a loss in value, white areas are expected to have little change in value, and blue areas are expected to experience an increase in value due to fire. The difference between the two is the assumption about how likely each pixel is to burn. The watershed function HVRA category is weighted three times the weight of the other categories. Other weighting schemes are available in the Rias Assessment attached as Appendix B.

Ecological Context

The goal of the Working Group is to increase landscape resilience. More specifically, to increase the resilience of the forested watersheds to drought, insects and disease, and climate change impacts (see Appendix A). Throughout the Southwest, there is an expected increase in potential for larger and more intense fires as a result of climate change. Current forest conditions are not resilient to these stressors.

Historic land management practices, including fire suppression, have affected forest structure, fuel loading and forest patterning on the landscape. Loss of fire has affected the warmer, drier forest types, ponderosa pine and dry mixed conifer the most, since these forest types were once dominated by frequent, non-lethal surface fires. Warm-dry mixed-conifer stands, once open and dominated by fire-tolerant species, have become densely forested by small shade-tolerant, fire-susceptible trees. Warm-dry mixed-conifer is considered to be outside its historical range of variation. Mature stands of cool-moist mixed-conifer have come to dominate more forest area where, in the past, healthy aspen overstories often prevailed. There is less certainty about how far cool-moist mixed conifers have departed from their historic fire regime, there are concerns about increased insect infestations and the loss of aspen as an important forest component. Large, high intensity fires that do occur in these types can be a threat to homes and surface water security. To return these forest types to healthy, more resilient conditions, lower elevation drier forest types will require extensive thinning and prescribed fire to reduce the risk of lethal crownfires. For the cool-moist mixed conifer types, managerial goals could include restoring aspen stands, breaking up the continuity of heavy fuels, and generally favoring more fire tolerant species like Douglas-fir (Upper San Juan Mixed-Conifer Working Group, 2012). The highest elevation forests dominated by Engelmann Spruce and Subalpine Fir are least departed from their original fire regime (Figure 6). An Infrequent, high severity, stand-replacing fires regime was the likely norm. However, the lack of fire at lower elevations may have impacted these high elevation forests by decreasing the likelihood of fires expanding from lower elevation forest types, creating a more homogenous stand age structure and expansion of spruce and fir dominance (Margolis and Romme, 2016 personal communication). These forests would not be a primary target for treatments. Since much of this forest type lies in Wilderness, managed wildfire might be used to break up fuel continuity or increase age diversity.

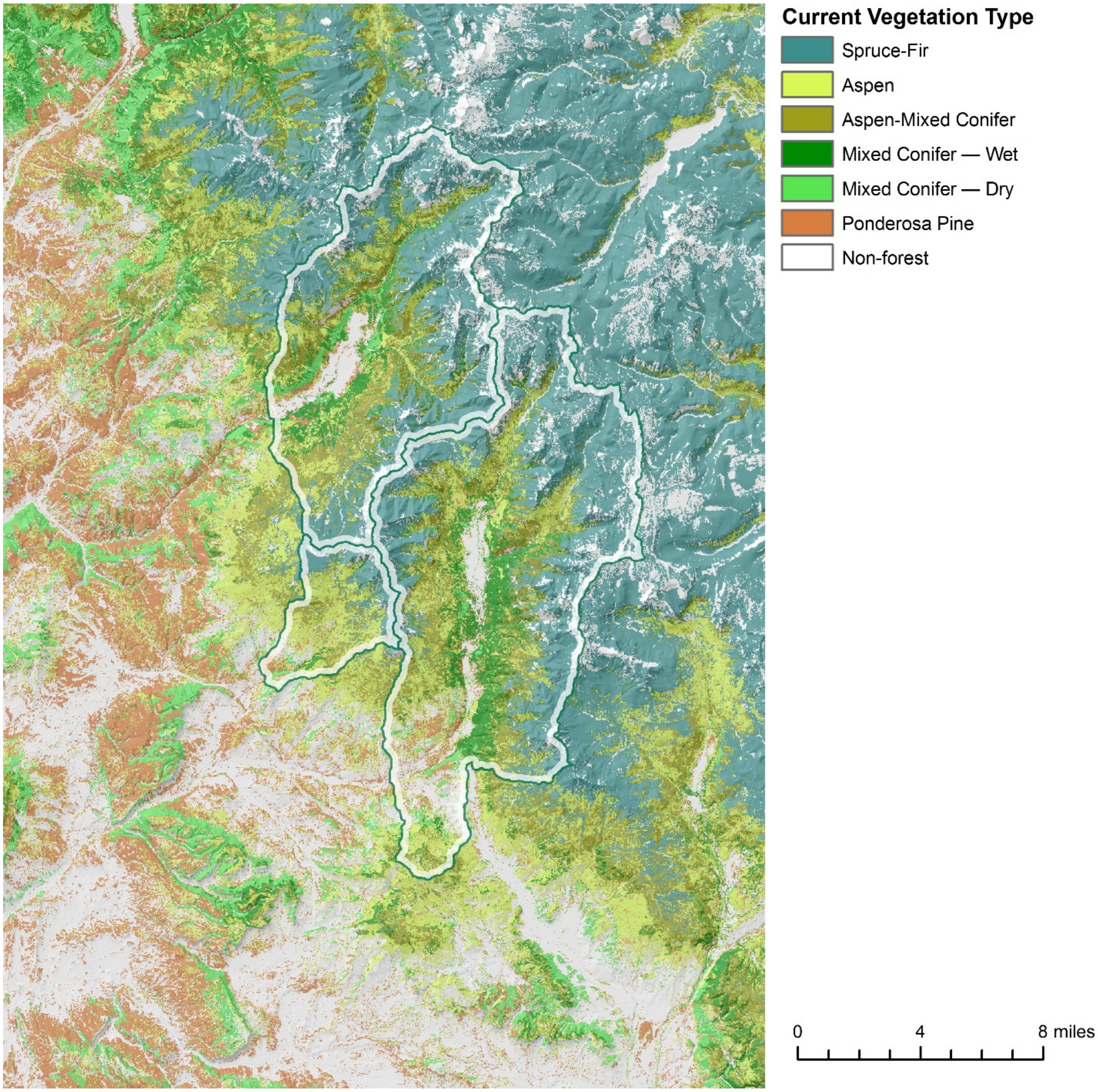

Figure 6. Map of forest type in the study area. The highest elevation areas are wetter and have an infrequent fire regime resulting in spruce-fir forest. Lower elevation areas within the strategy area are drier and have a frequent fire regime, resulting in ponderosa pine and mixed conifer. Aspen and a combination of aspen and mixed conifer dominate the lower slopes between the mixed conifer and spruce-fire forest.

Tools for Risk Reduction

Fire risk reduction consists primarily of actions that reduce fuel loading to mitigate crown fire potential and subsequent flooding and debris flows. Forestry techniques available to reduce tree density and fuel loading are hand or mechanical tree thinning, prescribed fire, and managed wildfire. Thinning is often coordinated with or used as a first step before prescribed fire. Managed wildfires are lightning ignited fires that occur under conditions when they can be used to reduce fuel loadings without undue risk. Mechanical thinning is considerably more expensive than either prescribed fire or managed wildfire. Over the life of the strategy we expect the proportion of the landscape where fire is used to reduce risk or maintain healthy conditions to increase. In Forest Service Roadless areas, fire is the preferred tool and will be used whenever possible. The Working Group has also discussed possible pre-fire debris mitigations such as strategically placed barriers, but there is not enough information at this time on the feasibility and utility of such structures to include these in the Strategy at this time.

Evaluating Return on Investment

A recently completed economics study commissioned by the RGWF shows that forest restoration and resilience treatments make sense as an investment (Hartwell et al. 2016). Upfront costs associated with forest restoration prevent later damages and costs associated with wildfire. By reducing the probability of a large fire (by breaking up fuel continuity), and reducing the severity of fires (by decreasing fuel loads), the damage that will occur is significantly reduced. In the scenarios used in the Return on Investment study, $9.2 million is spent on 17,811 acres of forest and fuels treatments which then saves $22.7 to $34.7 million depending on where fires occur. The study concludes that many organizations and stakeholders benefit from forestry treatments, ranging from local communities and landowners, to the municipalities and irrigation district that rely on SJCP water.

Identifying Opportunities to Reduce Risk and Restore Resilience

Once the risk to values has been identified, implementation of projects that can reduce risk is dependent on additional operational conditions, or opportunity factors. Opportunity factors include conditions such as nearness to roads, terrain steepness, existence of earlier treatments that can provide fire control points where controlled burning preferred tool, completion of NEPA planning requirements (on federal lands), occurrence within Roadless or Wilderness areas (also relevant on federal lands), landowner willingness, and landowner density. This last factor will help us to improve conditions across more acres more quickly. Portions of the watershed that have a high density of different land ownerships will require more time for negotiating agreements for treatments than areas with fewer landowners. These constraints are visible on basin-scale maps (Figure 7, Figure 8, and Figure 9).

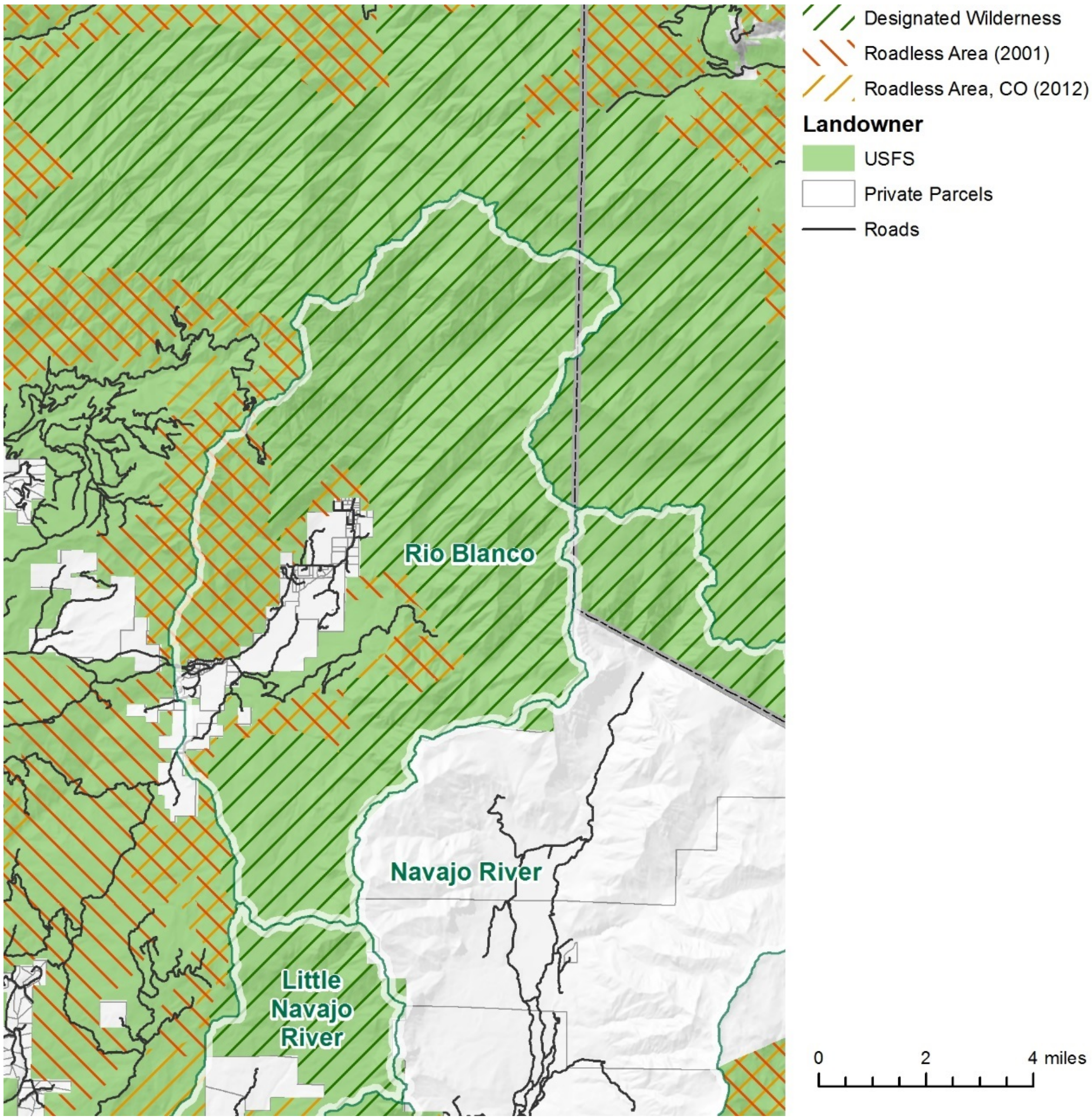

Figure 7. Land ownership in the Rio Blanco watershed.

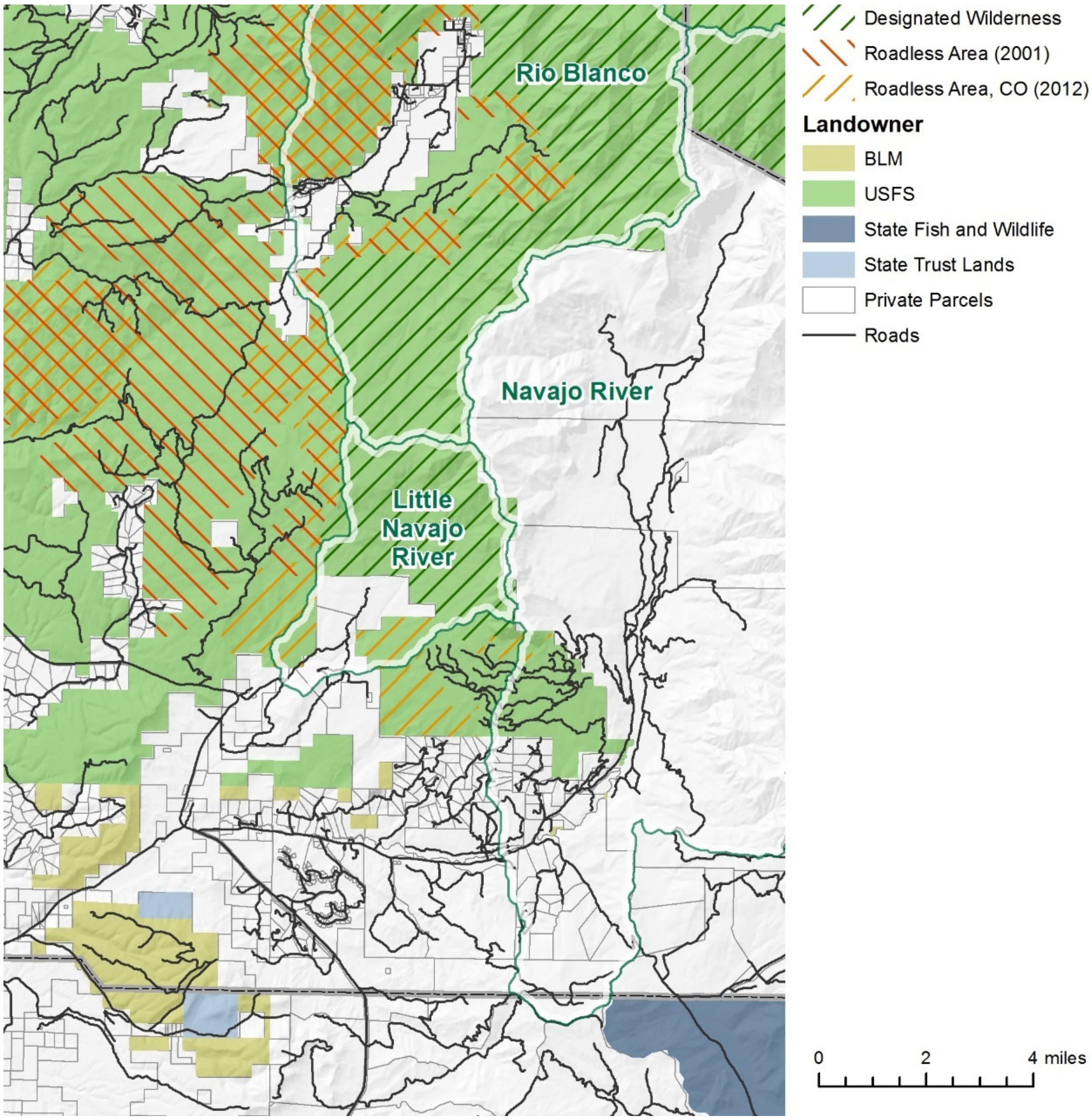

Figure 8.Land ownership in the Little Navajo River watershed.

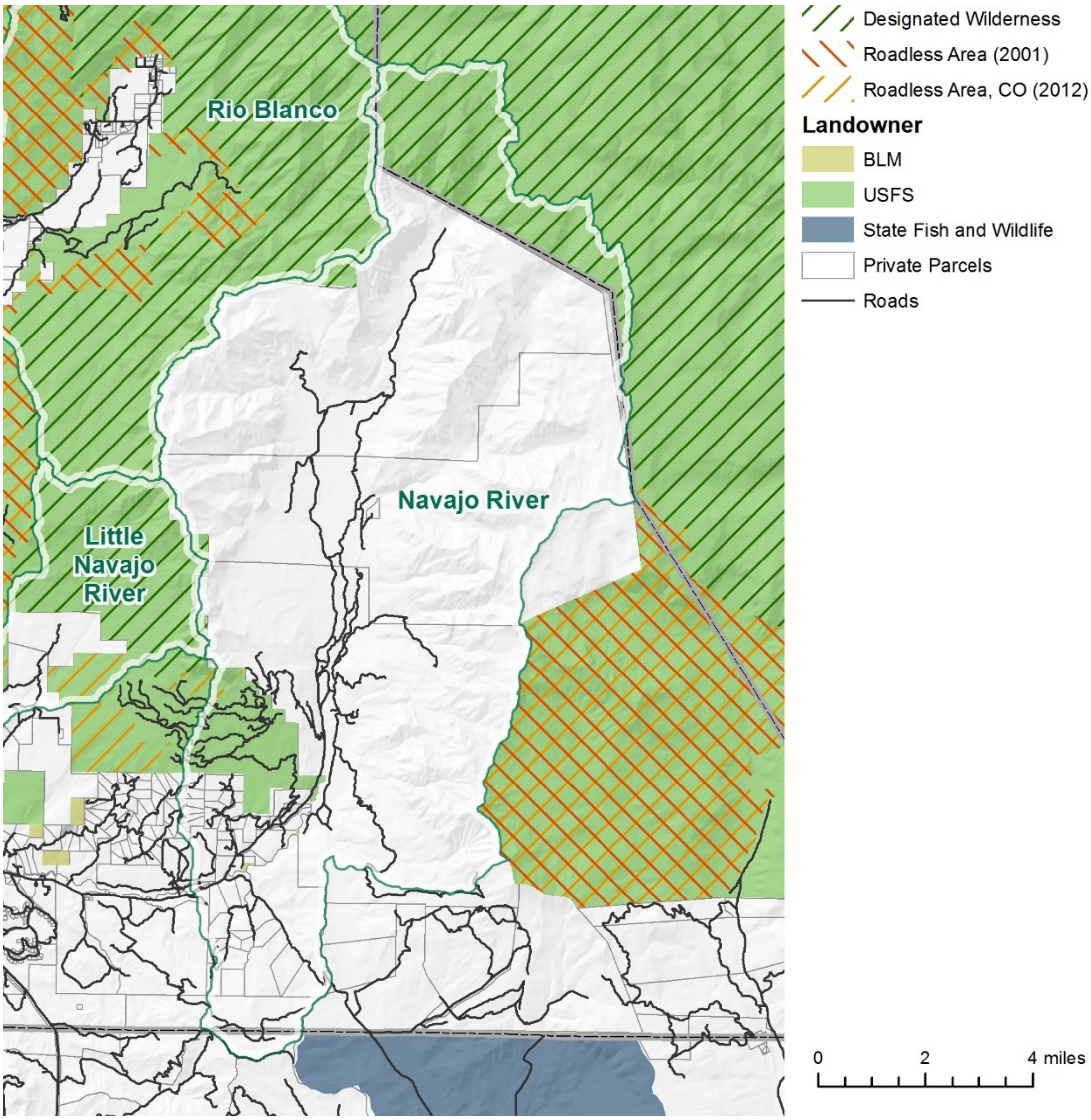

Figure 9. Land ownership in the Navajo River watershed.

Strategy Priorities

The Ten-year Resilience Strategy priorities are based on evaluating the risk and opportunity assessments together. The maps in figures 3, 4 and 5 show the SJCP Strategy areas at risk from high intensity fire. Figures 7, 8 and 9 show of the constraints to opportunity that exist on many acres of Forest Service lands in the strategy area: designated Wilderness, and Roadless status. For all federal lands, planning and public engagement are required before project implementation. In designated Roadless and Wilderness areas there are additional requirements. Thinning and prescribed fire treatments in Roadless areas can occur, but require a higher standard of pretreatment analysis and approval. Fire risk in Wilderness will most likely be addressed using managed wildfire, since thinning and prescribed fire are typically prohibited. Wilderness in the basins is generally at the higher elevations. Treating lower elevation forests reduces the chance of high intensity fires moving up into the upper elevations. In addition, if public and private land forests at lower elevations have a reduced risk of high intensity fire, federal fire managers will be more comfortable letting managed wildfire burn in Wilderness. Managed wildfires can help break up fuel continuity in the same way thinning and prescribed fires do in non-Wilderness areas.

For the first 1-2 years of Strategy implementation, the focus will be on private land treatments, initiating the required planning on public lands, and expanding public support for treatments on both public and private forested lands. For the Forest Service, using both thinning and prescribed fire are important. Prescribed fire is generally cheaper and more acres can be treated for a given budget. To create resilient landscape conditions, we expect that over time fire will take on a greater role in maintaining forest health. Fire cannot be used as a tool adjacent to private lands if those lands are not themselves thinned or burned. Treating private lands first provides immediate benefits and sets the stage for work on the federal lands. Public understanding and support accelerates the federal land planning process and encourages more private landowners to reduce risk on their properties. Projects that have broad public support are also more competitive for available federal funds. Therefore, investing in outreach and education is a key part of this strategy.

Year 1: Identify and conduct treatments on high risk private lands where landowners are willing and other opportunity factors exist; initiate planning in the Castle Creek area of the San Juan National Forest in the Blanco Basin; working group members initiate outreach to more landowners and the general public; encourage cross-boundary treatments between private and public lands; conduct pretreatment and initial post treatment monitoring.

Years 2-3: Continue treatments on high risk private lands; continue planning for mitigation treatments on high risk Forest Service lands- financial contributions from non-Forest Service sources to conduct needed archeological or wildlife surveys should be sought to accelerate treatments. Broaden community support for both fire and thinning treatments across the watersheds using existing partners' programs like Firewise; increase large landowner capacity for implementing prescribed fire; using the risk assessment maps, identify private lands where treatments would have outsized benefits and make outreach and engagement with these landowners a priority; monitor progress in reducing risk.

Years 4-10: Continue treatments on high risk private lands, conduct planning for, and implement mitigation treatments on high risk Forest Service lands; evaluate landscape resilience and strategy effectiveness including needs for retreatment on sites that have grown in and additional funding; revise the approach if needed to make continued progress

Exploration of Postfire Strategies

The Risk Assessment Framework includes postfire debris flow potential as well as wildfire risk, and priorities for forest treatments will include consideration of debris flow risk. While at this time it is not clear if debris flow risk can be mitigated by actions beyond forest treatment to reduce fire potential, the Working Group recognized that communities can prepare for postfire impacts by improving overall emergency response and communicating with the public fire and postfire risks they face. In the Rio Grande Headwaters, the Rio Grande Watershed Emergency Action Coordination Team (RWEACT). RWEACT was formed as a result of the 2013 West Fork Complex Fire that burned approximately 109,632 acres. The RWEACT Executive Director met with the Working Group in June of 2016 to share valuable lessons learned to prepare for and respond to postfire impacts (Table 1). The Working Group members expressed interest in developing a table of key emergency response contact information as a first step in postfire preparedness during Resilience Strategy implementation. Sample communication tools from other groups under review by the Working Group can be found in Appendix D.

Table 1. Recommendations from RWEACT for community preparation and response to postfire impacts.

Before the Fire Event

- Look across federal/private boundaries when addressing post-fire emergency response.
- Utilize existing fire simulation tools to discuss post-fire preparedness with partners and community members, e.g. simulation fire exercises with a variety of scenarios that include the decision-making process.
- Create a table of key emergency response contacts and their constituents for quick reference.
- Integrate Community Wildlife Protection Plans (CWPPs) and emergency response plans.

After the Fire Event

- Become familiar with the satellite imagery databases to productively engage in planning for fire and responding to postfire impacts.
- Look beyond traditional federal Burned Area Emergency Response program rules of engagement which are focused on risk to local infrastructure (homes) and impacts on federal lands. Incorporate water diversion managers and downstream water users in evaluating impacts and potential mitigation.
- Identify specific roadways, bridges, special habitats and other values at risk during the postfire response and clarify whether mitigation will be addressed through the BAER process or must be addressed by other programs or organizations.

Tracking Strategy Success

A monitoring and adaptive management plan has been developed for the Rio Grande Water Fund (Appendix C). The purpose of the adaptive management plan is to (1) track the environmental and economic effects of restoration activities; (2) ensure that investments are achieving their anticipated impacts; and (3) enable corrections to management strategies. The process of using monitoring information to make adjustments or corrections to management actions in order to achieve desired outcomes is called adaptive management. Each component of the plan begins with a monitoring question of interest to Water Fund signatories and stakeholders, including public and private resource managers within the Water Fund area. For each monitoring question, there is an identified a quantitative management objective or desired condition drawing from peer-reviewed publications, agency reports, other monitoring plans, and expert knowledge. For each question, the monitoring indicators or metrics that will measure whether the desired condition or management objective is met is articulated as well as the frequency of measurement and reporting, and the source and spatial scale of the monitoring data. Wherever feasible, monitoring is proposed at scales that are large enough to match the landscape approach of the Water Fund project. The SJCP Strategy proposes specific actions to build watershed resilience by reducing crownfire risk. Therefore, the primary monitoring questions for the Strategy will be those that target risk reduction efforts:

- How effective have treatments been at reducing modeled fire behavior?
- Do treatments in an area reduce ignition probability and crownfire potential fire in areas adjacent to forest treatments?
- How effective have treatments been in reducing observed burn severity during a wildfire?

Working Group partners will use a combination of forest stand based measures and remodeling using the same fire analysis tools used in the risk assessment at a 3- to 5-year interval to determine changes in burn probability and acres with crownfire potential. Based on the results, the Working Group can revisit how effective the Strategy is, adapt existing methods and improve them.

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